

Rink's book is the one that satisfied our curiosity the least. The sketches of Greenland life by natives, as translated from the "Greenland Journal," are interesting, but they tell us of very little except marvellous escapes from snowstorms and icebergs. The great endurance of suffering, as detailed in some of these stories, demonstrates that heroes can be found even in Greenland; the sublime spirit of martyrdom seems to breathe in the account of the "Kayakers cast ashore in a snowstorm."

Scattered through this volume are some sixteen plates, representing Greenland ways of life. These are exact copies of partially coloured drawings executed by natives entirely after their own ideas. The greater number are the work of a seal-hunter living in Kangek, who, falling sick, could not leave his bed. With the drawing which forms plate 16, he wrote to say that increasing illness prevented him from doing more, and he ended the letter with "from exhaustion I must cut my letter short, this too will be my future fate," and shortly after he died.

E. P. W.

OUR BOOK SHELF

A Sketch of the Geology of Leicestershire and Rutland.
By W. J. Harrison. (Sheffield: W. White.)

THIS is a creditable compendium of what is known regarding the geology of the two countries of which it treats. It was originally prepared by its author for White's "History and Gazetteer of the Counties," and has been reprinted in a separate form. It can be had embellished with twelve photographs of various parts of the crystalline nucleus of Leicestershire. These are not particularly successful. Mr. Harrison has done well to put the best of them as a frontispiece. It represents the "coarse ashy slates" of Charnwood Forest. As a local guide this book may no doubt be useful; fuller information can be found in the works which Mr. Harrison cites, and especially in the maps and memoirs of the Geological Survey.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Expected High Tides

If I may judge from the note published in your issue of November 8 (p. 38), and Mr. Jenkins' letter in the last number of NATURE (p. 45), it would appear that the general public are unaware of publications which contain information respecting high tides.

The Admiralty tide tables contain the time and height of every tide in the year for twenty-four of the principal ports of the United Kingdom. There are also numerous other tide tables published, which give the heights as well as the times of high water. Amongst these may be mentioned Holden's Liverpool tables, which contain, besides Liverpool, eight other ports (London included), and at Liverpool are held in higher estimation than the Admiralty tables, inasmuch as Holden's predictions take into account the effect of the diurnal inequality at Liverpool, which heretofore has been neglected in the Admiralty tables. There are also published at South Shields, Ainsley's, and at Hartlepool, Pearson's tables, and at Bristol, Arrowsmith's tables (formerly Bunt's), which have deservedly a high reputation for Bristol and the Bristol Channel ports generally.

Any one who will select from these publications the highest

perigeon spring tides about the time of the equinoxes, and will send them to the papers, can apparently earn for himself the credit of "predicting" high tides.

The increased range of tide in the Thames of about twenty inches during the last twenty years, is undoubtedly due, among other improvements, to the construction of the embankments, the increased water-way at the bridges at Westminster, and notably at Blackfriars, the improved line of wharfage continually being carried out, and the removal from the Pool of the colliers, which at low water acted as a dam, and prevented the improvement of the bed of the river.

An overflow in the Thames at above-average spring-tides is now a matter of meteorological circumstances only. It has been observed, I believe, without exception that the overflows have been caused by a strong northerly wind; the most disastrous overflows, however, have followed a strong south-west wind, changing suddenly to a stiff north-west wind. The reason is obvious. An increased amount of tidal water with a south-west wind and generally low barometer, is carried from the Atlantic to the northern parts of the North Sea, a sudden change in the wind to north-west brings the whole of this water to the southward, with probably little or no disastrous effects until it reaches the mouth of the Thames, where it meets with the tidal water of the English Channel brought through the Straits of Dover. It then rushes up the Thames, and an additional height is given to the water, amounting sometimes to as much as four feet or more if there is much flood water meeting it, and an overflow is the consequence. I find the effect of a south-west wind on the tide in the Thames, as traced on a self-registering tide-gauge I have placed at Greenwich pier, is to depress the water considerably. The high water of Monday morning succeeding the heavy gale of Sunday, November 11, was nearly two feet below the predicted height, the extreme pressure of wind, as registered at the Royal Observatory, being 31 lbs. on the square foot. In the middle of October the effect of a south-west gale was still greater, probably owing to its longer continuance, although the registered pressure did not exceed 23 lbs. No overflow need therefore be feared from a continued south-west gale.

Mr. Jenkins is perhaps unaware that Mr. Saxby has "predicted" high tides for many years, and that on one occasion, I believe in September or October, 1869, the Astronomer-Royal wrote reassuring the public that there was nothing extraordinary in the then forthcoming spring tides to occasion unnecessary alarm. If Mr. Saxby has discovered some law by which he can foretell the direction and force of the wind he will undoubtedly confer an inestimable boon by its publication, but from the following extract from the *Times* of November 5 he does not appear to claim any such knowledge:—"Capt. Saxby further states: 'If the wind should blow from a northerly quarter on either the 7th of November or 22nd of December next, very full tides may be reasonably expected.'" The spring tides about December 22 are slightly below average, and as no overflow has yet occurred with below-average spring tides, but little apprehension need be felt respecting them.

With respect to the actions of Venus and Jupiter; although theoretically they cause tides, the values have hitherto not been evaluated, being almost insensible.

The high tide of October 26th was entirely due to the northerly wind; the effect due to the maximum northern declination of the moon is very small in the Thames, and is more than counterbalanced by its effect in decreasing the value of the lunar semi-diurnal tide.

Mr. Jenkins' statement respecting two great tides revolving through the year exactly six-and-a-half synodic months apart is merely on account of thirteen semilunations being very nearly equal to seven anomalistic months, and therefore the lunar perigee has again the same phase with respect to new or full moon. I may mention that ninety-nine semilunations exceed four years by about eighteen hours only, and also fifty-three anomalistic months by less than thirty-three hours. So that after a cycle of four years the perigeon spring-tides fall very nearly on the same days of the year. This of course fails to take into account the variations due to the moon's declination.

The following table of the heights of the above-average spring-tides for London for next year may be useful not only to riverside owners and dwellers, but also to marine naturalists, who will on these days have unusually favourable opportunities at low-water of engaging in their pursuits. If at such times the barometer should be high the low-water level will be still further depressed. It will also act as a guide to tourists wishing to avail themselves of the best chances of witnessing the bore in rivers,

notably on the Severn, which, according to Mr. Alfred Tylor, F.G.S., is seen to best advantage with a rising sun from Stone-bench Inn, about three miles below Gloucester.

1878.	Height above average.	1878.	Height above average.	1878.	Height above average.
	ft. in.		ft. in.		ft. in.
Jan. 20 p.m.	0 4	April 17 a.m.	0 8	Sept. 1 a.m.	1 3
" 21 a.m.	0 7	" " p.m.	0 11	" " p.m.	0 11
" " p.m.	0 9	" 18 a.m.	1 1	" 2 a.m.	0 7
" 22 a.m.	0 10	" " p.m.	1 3	" " " "	" " "
" " p.m.	0 11	" 19 a.m.	1 3	" 26 a.m.	0 1
" 23 a.m.	0 10	" " p.m.	1 0	" " p.m.	0 7
" " p.m.	0 7	" 20 a.m.	0 9	" 27 a.m.	1 0
" 24 a.m.	0 4	" " p.m.	0 5	" " p.m.	1 4
		" 21 a.m.	0 1	" 28 a.m.	1 7
Feb. 18 a.m.	0 5			" " p.m.	1 8
" " p.m.	0 11	May 16 a.m.	0 1	" 29 a.m.	1 7
" 19 a.m.	1 4	" " p.m.	0 2	" " p.m.	1 4
" " p.m.	1 5	" 17 a.m.	0 3	" 30 a.m.	1 1
" 20 a.m.	1 6	" " p.m.	0 3	" " p.m.	0 9
" " p.m.	1 6	" 18 a.m.	0 3	Oct. 1 a.m.	0 4
" 21 a.m.	1 5	" " p.m.	0 2		
" " p.m.	1 3			" 25 a.m.	0 2
" 22 a.m.	0 10	July 31 p.m.	0 3	" " p.m.	0 6
" " p.m.	0 4	Aug. 1 a.m.	0 5	" 26 a.m.	0 10
		" " p.m.	0 7	" " p.m.	1 0
Mar. 18 p.m.	0 3	" 2 a.m.	0 9	" 27 a.m.	1 2
" 19 a.m.	0 9	" " p.m.	0 9	" " p.m.	1 4
" " p.m.	1 3	" 3 a.m.	0 9	" 28 a.m.	1 2
" 20 a.m.	1 6	" " p.m.	0 6	" " p.m.	0 11
" " p.m.	1 9	" 4 a.m.	0 3	" 29 a.m.	0 8
" 21 a.m.	1 9			" " p.m.	0 4
" " p.m.	1 7	" 28 p.m.	0 1		
" 22 a.m.	1 5	" 29 a.m.	0 6	Nov. 24 a.m.	0 1
" " p.m.	1 1	" " p.m.	1 0	" " p.m.	0 3
" 23 a.m.	0 8	" 30 a.m.	1 3	" 25 a.m.	0 4
" " p.m.	0 1	" " p.m.	1 5	" " p.m.	0 4
		" 31 a.m.	1 5	" 26 a.m.	0 5
April 16 p.m.	0 4	" " p.m.	1 5	" " p.m.	0 3

From the above table it appears that the highest tides of the year will occur on March 20-21 and September 28. The heights will be found probably to exceed those of the Admiralty Tables, as I have employed larger factors in the necessary corrections to the semi-menstrual inequality.

As a London tide table appears to be a desideratum, I have been induced to publish one for next year, in which the "danger" tides will be distinguished in a new, bold, and unmistakable manner.

EDWARD ROBERTS

3, Verulam Buildings, Gray's Inn, November 17

Rainfall in the Temperate Zone in Connection with the Sun-spot Cycle.

THIS month's number of the *Nineteenth Century* contains an article on the connection of rainfall with the eleven years' cycle of sun-spots. It takes a carefully-selected area in which such a coincidence, if it existed, would be well marked. The great tract of water spreading southwards from Asia to the southern pole affords an arena for the undisturbed play of solar activity. It may readily be understood that any excess of solar energy has a more direct and uniform influence upon the rainfall gathered from this vast aqueous expanse, than it would have upon smaller areas of water intermingled with tracts of land, and cut off from each other by ranges of mountains, as in the European and American continents. Other reasons exist which would render solar influence a more directly potent factor in the rainfall gathered from the Indian Ocean than in that of the temperate zone. Without doing more than alluding to the fact that sun-spot activity is confined to a belt of considerable thickness on either side of the sun's equator, there are several well-ascertained causes which would render an excess of solar activity more directly felt in the equatorial regions of our earth than in those nearer the poles. While, therefore, I believe that the coincidence of a rain cycle and of a cycle of wind disturbances with the eleven years' cycle of sun-spots, has now been established as

regards the Indian Ocean and the Madras rainfall, I am anxious to guard against the conclusion being pushed too far. The article in the *Nineteenth Century* proves much, but it would be a misfortune at this still early stage of the inquiry, if wider inductions were drawn from it than are justified by the evidence which it brings forward.

It seems right, therefore, to state that so far as my investigation of the rain returns of the temperate zone yet enables me to form an opinion, the cyclic coincidence of the rainfall with the eleven years' cycle of sun-spots, seems to shade off in extra-tropical regions until it ceases to exist at all. This opinion is based upon an examination of the returns of between one and two hundred stations in different parts of the world, but only with regard to one-third of them is the evidence sufficiently complete as to raise more than a presumption either for or against the existence of a cycle. Further, I have not yet been able, except in comparatively small groups of stations, to examine the monthly returns or to separate the winter from the summer rainfall. This separation forms one of the first essentials to arriving at a final opinion on the question. Subject to these remarks, I beg to state the facts with regard to the rainfall of the northern extra-tropical zone in India, Europe, and America. It is chiefly with the first and last-named countries that the present contribution will deal.

In my "Cycle of Drought and Famine," printed in India on the commencement of the late dearth, I mentioned that the rainfall which, in periods of minimum sun-spots, passes uncondensed over the Southern Presidency, might possibly "fall in the temperate zone. The excessive rain, if it takes place anywhere, will probably be found in India between the 22nd and 32nd degree of north latitude, to the south of the great Himalayan partition wall." The conjecture was based upon the configuration of the Indian continent, which, in its lower and middle regions, receives the rainfall gathered from a vast ocean, and is provided with a barrier at the upper end to arrest the rain-clouds on their further progress northward. Prof. Archibald's examination of the rainfall in Northern India now throws a clear light on this side of the question. He has published in the leading Calcutta paper, the *Englishman*, a series of carefully-compiled returns from stations within the ten degrees of latitude above mentioned. He shows that the rainfall of the sub-tropical region, from 22° to, say, 30°, is in some respects (but only in some respects) complementary to the rainfall of Southern India, and in a recent letter to me he thus summarises his conclusions:—First, the winter-rainfall of Northern India varies inversely with the sun-spots in a well-marked manner at all the stations. Second, the summer rainfall varies directly with the sun-spots, in a manner well marked in the north-western provinces, by no means marked in the lower provinces of Bengal, but sufficiently well marked when the returns of the several stations are combined.

Let us examine the meaning of these facts. The returns from Madras and Bombay (lately published in *NATURE* and elsewhere) prove that when the summer monsoon strikes Southern India, its aqueous burden varies directly with the sun-spots. Prof. Archibald's returns now show that the rainfall brought by the summer monsoon to Northern India also varies directly with the sun-spots. But they prove more than this. They show that the rain-clouds which, in years of minimum sun-spots pass over India without dropping their watery burden, are found, on their being stopped by the Himalayan partition wall, to be charged with a more than average surplus (so to speak) of moisture. In Northern India, therefore, the summer monsoon, on its passage up, brings, as in Southern India, a rainfall varying directly with sun-spot activity; but the winter rainfall, *i.e.*, the immediate rebound of the rain-clouds from the Himalayan barrier, varies inversely with sun-spot activity. I say the immediate rebound, for it must not be forgotten that the north-eastern monsoon (October to December), when it strikes Madras in its full development, after collecting its aqueous freight from the Bay of Bengal, follows the same law as the summer monsoon (May to September), and varies directly with the sun-spots.

Passing from the sub-tropical region of Northern India (22° to 32° lat.) to the temperate zone, we find the evidence of a cycle either very faint or altogether wanting. With regard to Europe, I am not yet prepared to offer any new facts. The existing evidence only amounts to this: (1) Mr. Baxendell, from observations for a comparatively short period but very carefully recorded and scrutinised, came to the conclusion that even at an English station, notwithstanding the manifold disturbing influences incident to our insular meteorology, changes take place in the rainfall as well as in the temperature and barometric pressure,